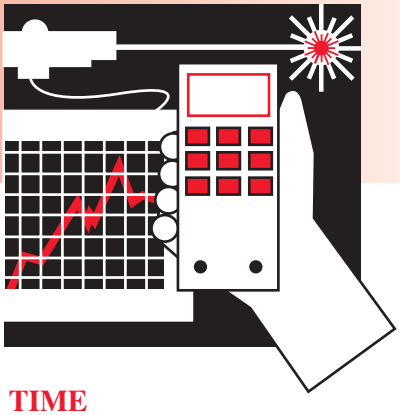
SENSORS & CONTROLS

Project Fact Sheet



Temperature Measurement in Hostile Environments with Microwave Radiometry

Using microwaves to reduce down time and increase productivity in industry

Benefits

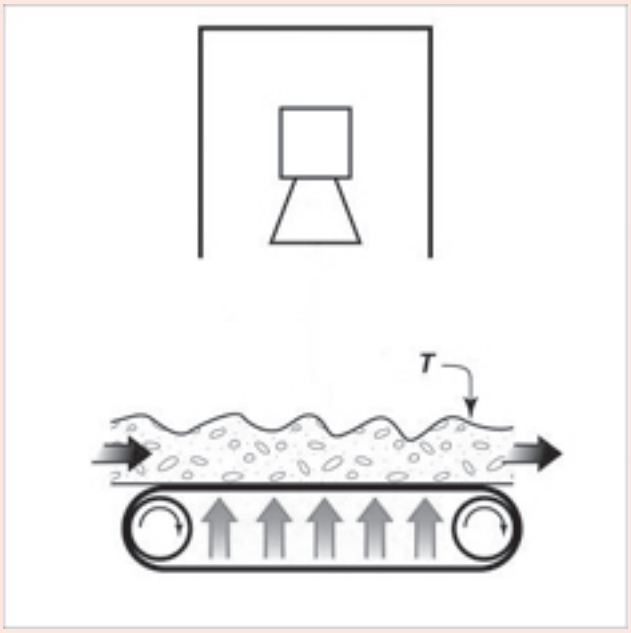
- Offers savings of 1.23 trillion Btu by 2010
- Measures temperatures where other instruments cannot and allows better control of industrial processes

Applications

Several of the OIT Industries of the Future stand to benefit from this research: forest products (paper mills), chemicals (plastics manufacturing), metal casting (foundries), and possibly the steel and glass industries as well.

Improving the monitoring and control of process temperatures can lead to significant improvements in energy efficiency and product quality as well as reducing the amount of waste products generated. However, a wide variety of energy-intensive industries involve processes and environments in which it is difficult or impossible to monitor the process temperature. These situations include certain types of kilns in the cement, glass, and ceramics industries, molding areas in foundries, and various heating and drying processes in the paper, plastics, and chemical industries. Direct contact for temperature measurement is difficult when the product is in motion or can be contaminated or damaged by mechanical probing. While infrared sensors and cameras can sometimes provide usable temperature data in these cases, infrared radiation is scattered and absorbed by smoke, water droplets, dust, and other airborn particulates that are often present. Because of these problems, there are still many critical manufacturing processes whose temperatures cannot be monitored.

Typical Application



Sensor suspended above heated conveyor belt measures material temperature T through dust and smoke.

Southwest Texas State University in collaboration with the University of Texas at Austin is developing a non-contact remote temperature measurement instrument using microwave radiometry. Bench-scale tests have shown that this method provides accurate temperature data on materials of commercial interest. Microwaves are almost completely unaffected by particulates that block infrared rays. The instrument will be used in a series of field trials at commercial plants where this type of temperature measurement is expected to be most useful. If this technology is adopted widely, we estimate it will lead to an annual energy cost savings in the U.S. of up to $120 million.

Project Description

Goal: To demonstrate the usefulness of microwave radiometry in remote temperature measurement situations in industry where other temperature-sensing technologies cannot be successfully used. The goal will be met by: (1) building a microwave radiometric temperature sensor suitable for field use at industrial sites and (2) testing the sensor at a variety of representative industrial sites to verify its usefulness under conditions that prevent other remote temperature sensors from operating. Other goals include the publication of results as appropriate and the eventual transfer of the technology to a firm interested in commercializing the product.

Progress and Milestones

The following are the main tasks to be performed:

- The radiometer unit will be designed to be compact, stable, reliable, rugged, and portable enough for extensive field tests.
- The unit will be assembled and initial troubleshooting and modifications as necessary will be performed.
- Lab and field verification tests will be performed. These tests will be performed at a variety of field sites where materials of known properties and temperatures are being processed. These tests will verify the accuracy and stability of the unit with laboratory-grade equipment and will reveal any problems that may arise in the field.
- Three different field sites with high potential to gain advantages from the use of this technology will be identified with the assistance of the industrial partner. At each site, the instrument will be set up in a temporary installation and its output made available to plant personnel for process monitoring and control purposes.

Economics and Commercial Potential

Commercial introduction of this technology is expected by 2005. Annual energy savings by 2010 would be 1.23 trillion Btu. By 2020 the savings would grow to 11 trillion Btu.

The Inventions and Innovation Program works with inventors of energy-related technologies to establish technical performance and to conduct early development. Ideas that have significant energy-savings impact and market potential are chosen for financial assistance through a competitive solicitation process. Technical guidance and commercialization support are also extended to successful applicants.

For project information, contact:

Karl D. Stephan
Southwest Texas University
601 University Drive
San Marcos, TX 78666
Phone: (512) 245-2137
Fax: (512) 245-3052
kdstephan@swt.edu

For more information about the Inventions and Innovation Program, contact:

Lisa Barnett
Program Manager
Inventions and Innovation Program
Phone: (202) 586-2212
Fax: (202) 586-7114
lisa.barnett@ee.doe.gov

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Office of Weatherization and Intergovernmental Program
Energy Efficiency and Renewable Energy
U.S. Department of Energy
1000 Independence Avenue SW
Washington, D.C. 20585-0121

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